Instrumentation

Advanced Magnetostrictive Regulator and Valve

An all-electric, highly reliable and accurate regulator and valve system

NASA Marshall Space Flight Center has developed a set of unique magnetostrictive (MS) technologies for utilization in pressure regulation and valve systems. By combining MS-based sensors with a newly designed MS-based valve, Marshall has developed an advanced MS regulator. This innovative approach provides both a regulator and a valve with rapid response times. In addition, the components are lightweight, compact, highly precise, and can operate over a wide range of temperatures and pressures. A prototype of the MS valve has been developed and NASA is seeking partners for licensure of this novel technology.

BENEFITS

- **Fast Response:** Offers precise operation with response times up to an order of magnitude faster than current technologies.
- **Increased Reliability:** By using fewer moving parts and no external or dynamic seals, friction, wear, and leaks are reduced.
- **Increased Redundancy:** Novel design allows alternate parallel pathways to be implemented.
- **Self-Adjusting:** Continuously senses conditions to maintain precise control and reduce setpoint drift.

technology solution

THE TECHNOLOGY

Magnetostrictive materials used in valves developed at Marshall allow the valve to be opened and closed via application of a magnetic field to the outside of the valve envelope. This process contains all moving parts inside the pressure shell, eliminating the need for feedthroughs or mechanical seals. Marshall's valve concept moves the valve coil outside a fluid boundary, keeping the coil from contacting the fluid under flow. This concept features a small valve design – no greater than 1/16" OD, and accommodates a digital design whereby multiple elements are used to accommodate larger throughput needs. This results in a highly effective, redundant valve system.

Building on this concept, Marshall's MS regulator is comprised of the MS valve element, an MS-based pressure transducer, and a servo-circuit to control the current to the valve coil. This all-electric design enables highly accurate and highly reactive regulation. As the current changes, the magnetic field strength adjusts, causing the valve poppet to reposition, bringing the pressure back to the setpoint.

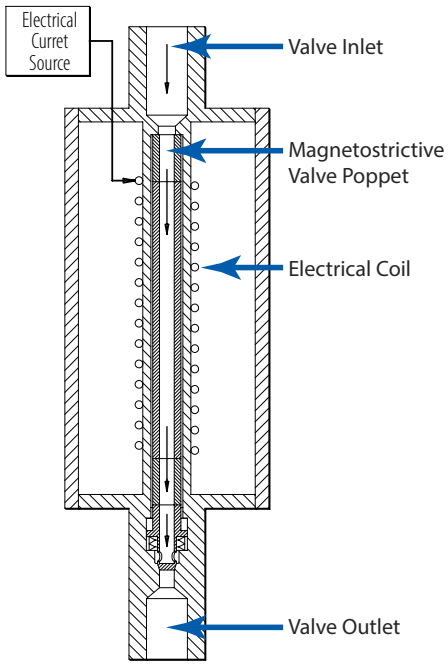

FIGURE – Diagram illustrating the operation of the NASA magnetostrictive valve technology. A current applied via an electric coil to the magnetostrictive valve poppet closes the normally-open valve.

APPLICATIONS

The technology has several potential applications:

- Pressure-fed rocket propulsion systems
- Aircraft engines
- Automotive fuel systems
- Industrial systems – Oil-flow control, air and gas compressors, steam turbines, power recovery, and power-generating equipment
- Biomedical devices – Device implants requiring pressure/flow control, and drug metering systems

PUBLICATIONS

US Patent No. 8,464,750
US Patent No. 8,291,776
US Patent No. 7,469,878

More Information

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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